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REMARKS

Reconsideration of the above-referenced application is respectively requested in view of the above amendments and these remarks. Claims 1-16 are currently pending.

According to the Office Action, claims 1-16 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Divsalar et al. "Improving Parallel Interference Cancellation for CDMA", IEEE Transactions on Communications, Vol. 46, No. 2, February 1998. Applicant has amended claims 1, 8 and 11 to further clarify the claimed invention.

As stated earlier, the present invention is directed to a method and apparatus to cancel interference in a multiple access communication channel. The interference to be cancelled by the present invention comes from other users that are accessing the system simultaneously in a CDMA network. While the present invention is directed to the signal degradation, it is more accurately directed to the degradation of the signal caused by the multiple users in the communications channel. As mentioned above, claims 1, 8 and 11 have clarified that the present invention uses an approximation of the characteristic of the multiple access communication channel to estimate the interference factor that is then used to cancel the second data component from the signal and recover the first data component of the signal. The present invention is directed to making the ideas and concepts that are discussed by Divsalar work in a real life environment including DS-CDMA systems such as CDMA2000 and W-CDMA wireless communication systems In DS-CDMA systems it is not possible to determine the exact effect, e.g. interference, a characteristic can have on a system. Accordingly, the present invention, as seen in claims 1, 8 and 11, relies on an approximation of the characteristic to estimate the interference factor.

In an embodiment of the present invention, the present invention does this on power control group by power control group basis to capture the time-varying statistics of a real system. Pilot channel analysis can be included in the analysis. In an operational system, one would need a specifically designed processor to compute the tanh(x) component disclosed by Divsalar. Instead of directly

computing these components, the present invention makes approximations of them. Accordingly, the present invention uses the disclosed piece-wise linear approximations.

Moreover, Divsalar discloses the use of the variable *k* as a stage index (for the stage number in the interference cancellation process.) The present invention, however, relies on a one-stage version of the architecture as seen by the amendments to claim 1 and by the use of the "second data component" in claims 8 and 11. Thus, the index *k* is not present. This should not be confused, however, with the time indices relating to the time-varying coefficients in the present invention.

Applicant respectfully submits that there is a difference between the approximation claimed by the present invention and the estimations cited to in Divsalar. Estimation is for random variables one cannot measure but can estimate based on statistics. Approximation, on the other hand, is for functions that simplify the computations where a value "close enough" suffices. According to the present invention, approximations of values such as for tanh(x) in the form of piece-wise linear functions provides an advantage over determining the actual values of the tanh(x). It should be noted that Divsalar's Eq. 17 uses linear combination of the Y_1 and ã terms should not be confused with non-linear estimates of the form E[X | Y]. Piece-wise linear means that that the function is made up of straight lines ("affine" as used in the Specification says that the pieces do not cross the origin, so are of the form y=ax + b where b is not equal to 0).

In practice, the channel changes because of motion, interference, weather and other factors so that the system's statistics change. For the interference cancellation mechanism to work, these factors need to be taken into account. Thus, the present invention relies on power control groups to estimate the quantities of interest. Power control groups are used because that is how the frames are divided in DC-CDMA systems for processing. Faster divisions would produce unreliable estimates, and slower divisions would fail to capture statistical variations in the system. In other words, the present invention recognizes the

different power levels of the system. Divsalar, however, uses a channel with equal powers. See Figures 6 and 7.

In addition, Applicant respectfully traverses some the characterizations of Divsalar made in the Office Action. With respect to claim 1, Eq. 9 and E_b/N_n are cited against the determining step. Eq. 9 is the redefinition of $\hat{I}$ (the estimate of I) from Eq. 7 after the stage index k is introduced. Divsalar is for a multi-stage architecture. As seen in amended claim 1, the present invention, however, is for a single stage. Claims 8 and 11 are consistent in this feature as they are directed to the second data component received on the multiple access channel.

Returning to claim 1, Eq. 18 is cited against the estimating step. Eq. 18, however, shows the estimate obtained by Maximum-likelihood ratios under the simplifying assumptions such as equal user power made throughout the paper. Eq. 19 is the estimate obtained by Minimum Mean-Squared Error under those assumptions. Eqs. 18 and 19 do not suggest using approximations as required by the claims 1, 8 and 11.

Turning to claim 4, it is stated that Eq. A.6 discloses the function. Eq. A.6, however, discloses using a tanh(x) function. The present invention, as seen in claim 1 from which claim 6 depends, relies on an approximation of the tanh(x) function.

With respect to claim 5, Applicant respectfully contends that Divsalar does not disclose that the function comprises a piece-wise linear estimation of the hyperbolic tangent. Divsalar states that a tanh(x) is used and does not state that an approximation of the tanh(x) is involved. The statements made with respect to claim 6 are also incorrect. Divsalar does not disclose a piece-wise linear estimation of a probability error function.

With respect to claim 7, it is contended in the Office Action that Divsalar discloses E_b as the signal estimation and N_n as the noise estimation. These constants are not found in the reference. Moreover, Divsalar states on page 260 that the "user's power" are not discussed in the paper. This observation also applies to the estimating step in claim 8.

Continuing with claim 8, Divsalar does not mention a power control group. In DS-CDMA technologies like CDMA2000, information is transmitted in frames

of 20 ms, each frame being divided into 16 chunks called power control groups. This is because the transmitted power can change over each power control group following power control commands. In WCDMA, the 10 ms frames are divided into slots and again power control changes the power for each slot. None of this is described by Divsalar. For the subtracting step, the Y term referred to in the Office Action is not the aggregate received signal as believed. Rather the Y term is defined based on y in Eq. 5, which is a normalized projection.

With respect to Claim 11, Applicant's comments found above still apply. As stated above, for claim 13, Divsalar does not discuss piece-wise linear functions in the text. Moreover, Eq. A.2 is a conditional probability function that does not provide any details regarding an error function, as required by the claim.

In view of the foregoing remarks, Applicants submit that the Divsalar does not disclose, teach or otherwise suggest the present invention as found independent claims 1, 8, and 11 and are in condition for allowance. Applicant respectfully requests that the rejection under Section 103(a) be withdrawn. Applicant further submits that dependent claims 2-7, 9-10 and 11-2 are in condition for allowance at least by virtue of their dependency on claims 1, 8, and 11.

As the Applicant has overcome all substantive rejections and objections given by the Examiner and have complied with all requests properly presented by the Examiner, the Applicant contends that this Amendment, with the above discussion, overcomes the Examiner's objections to and rejections of the pending claims. Therefore, the Applicant respectfully solicits allowance of the application. If the Examiner is of the opinion that any issues regarding the status of the claims remain after this response, the Examiner is invited to contact the undersigned representative to expedite resolution of the matter.

Please charge any fees associated herewith, including extension of time fees, to **50-2117**.

Respectfully submitted,
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